

TO SHAPE IDEAS OF THE YOUTH.

Inductive and Deductive Methods
of Teaching.

PAPER BY JOHN BUSH, OF KAUALA.

Delivered Before Semi-Annual Meeting of Kauai Teachers' Association. Some Pertinent Theories of Practical Use in School Rooms, Etc.

The following paper on "The Inductive and Deductive Methods of Teaching" was read by John Bush, principal of Kilauea School, at the February meeting of the Kauai Teachers' Association:

I propose, in the first place, to define the terms induction and deduction, as applied to the pursuit of knowledge, and then give a very brief historical account of the manner in which the terms have arisen, and then proceed to contrast the two methods of teaching, as understood by the inductive and deductive.

First—Induction: When facts are discovered and put together and from them inferences are drawn, either of particular facts yet unknown, or of general truths to which all the details have relation, such inference is termed induction.

On the other hand, our knowledge of the world and of life is not wholly dependent on discovery of individual facts and inferences drawn by induction from them; a long history of such inferences has developed in us an insight for general conclusions, for truths which, though the result of induction, are accepted as beyond the need of that process for confirmation—truths which our long experience of them has made practically self-evident. When one of these general truths is made the basis of an argument, and from it is inferred another truth, the process is termed deduction. Briefly, when by observation of individual facts we arrive at general conclusions, we proceed by induction, and when we apply a general statement to particular instances we use deduction.

It may readily be seen from the definition of these two terms that all in the pursuit of knowledge and the investigation of science must proceed in the first instance by induction, not by deduction.

Francis Bacon, who lived from 1561 to 1627, was the first who placed accurately before the world the philosophy, the importance, the method and the extensive application of the inductive method. He enunciated two great truths—that man's knowledge of external things is founded on observation, and that true science requires the harmonious working of all his powers.

Previous to the time of Bacon the methods of investigating truth were the philosophical and the empirical (and the superstitious). In philosophical method experience was but partially consulted, as in the scientific treatises of Aristotle, its place being supplied by a verbal logic drawn from the philosophy of language. In empirical methods science was founded on a hasty generalization of facts, as in the reasonings of Kepler.

In place of these methods, Francis Bacon put forth the inductive method, and hence he is (rightly) regarded as the father of experimental science.

The first practical effect of Bacon's writings was produced in the department of physics, but it is also maintained by many that modern psychology owes much to his writings. It was not, however, until the time of Pestalozzi that the inductive method was applied to the instruction of the young.

Pestalozzi, who was born eleven years after the death of Bacon, was the pioneer who broke new ground in elementary instruction, and led the way from mechanical abstract methods of teaching to those which are more natural and psychological.

He laid down the principle that all mathematical knowledge is founded on immediate observation, and therefore we must proceed from the concrete to the abstract by means of numerous examples. This educational truth was not only of vast importance to pupils in schools, but it opened up to teachers the psychological principles of all pedagogues.

Previous to the time of Pestalozzi, pupils at the commencement of a subject were confronted by a formidable array of generalizations and definitions which tended to discourage and confuse them at the outset.

As the 12th of this month is the 150th anniversary of the birth of this great educational reformer, I take this opportunity of paying this tribute to the memory of him who introduced the inductive method of teaching.

Now, I have hitherto said so much in praise of the inductive method, it may be thought that the deductive is of very little value; but I wish to point out that the deductive method is also of value if used judiciously. Both the methods are right and necessary in their proper place; they are parts of one whole, related to each other as antecedent and consequent.

The observation of particulars is an incomplete process unless in the application of general principles, but the application of such principles must be feeble and unreal unless founded on previous observation of particulars.

Generally speaking, the teacher will find the inductive procedure suitable for young pupils at the commencement of a subject, and the deductive to those who are well advanced in that particular subject.

Thus he will always have occasion for both, since there will always be

some branch of knowledge in which even his advanced pupils have done little more than make a beginning; and as the mind's operations are not marked off from each other by mechanical boundaries, it will sometimes be proper to use the inductive method in the early part of a lesson and the deductive in the latter part.

Take, for example, Swinton's Language Primer, which proceeds on the inductive method, the deductive being very sparingly used.

First the child by observation—that is, by means of the senses—is taught what an object is; then he is led on to the word which names the object, and then by illustration and questioning he learns that a noun is a name-word; by a similar process of induction he is led to the new fact that a verb is an action-word.

Having learned these two general truths, he is next required by a process of deduction to apply this knowledge to new particular cases: in a series of short sentences he is called upon to point out which words are nouns and which are verbs, and give the reason. The inductive method is then again resorted to for the purpose of drawing out from the child that an adjective is a quality word. This is the plan adopted throughout the book advancing from the concrete to the abstract so that general statements are drawn out by inductive methods, and these made the basis of further instruction by deductive methods.

In the preface to Swinton's Elementary Grammar and Composition he admits that in pressing the inductive method, proper attention must be made to grammatical forms that is the inductive method must be used in such a way as to build up the subject.

He says in the actual test in the school room during the past four years it has been found that the vitalizing elements of the language lessons are first, the inductive method of unfolding the theory of language and secondly, the influence of constructive work. Accordingly, in the present book these approved features have been retained, but wherever the book was thought to be weak, as for instance in the too great a neglect of grammatical form, it has been "toned up."

Gruber's method of teaching arithmetic proceeds on the inductive method and recognizes the psychological fact that nearly all the knowledge obtained by the child in its earlier years is by means of the senses; so it calls for the use of things, balls, marbles, cubes, blocks. It uses objects separately until the child is thorough master of the number and can make the number abstractly. After a time the simple remembrance of the objects used will always be sufficient to recall to the consciousness the number until no object is longer necessary and the pure relations number are found. Then the child needs no object or intermediate process to help him to know the number for he knows it instantly as he passes from the object to the symbol.

As the pupil advances in arithmetic every principle or formula should be elucidated from the pupil by the inductive process; then the general rule applied by a process of deduction to the solution of other problems. Take for example when one wishes to teach fractions; we may take an actual orange or apple, or more conveniently a representation of an apple in wood, divided into halves, quarters, eighths, etc., which the children can actually see and handle, and by suitable questioning the principle can be elicited from them that the value of one of the equal parts into which a whole thing is divided depends upon their number; and also that the less the number of parts the greater their value, and the greater the number of parts the less their value. (This is the plan adopted in Fecklin's arithmetic.) Every new rule can be drawn on by a series of inductive exercises, chiefly oral, and then the rule thus obtained by induction is applied to work out written examples by deduction.

But I must not pursue this subject further, as I must remember that the subject of my paper is the inductive and deductive methods of teaching, and I have only brought forward the special subjects, grammar and arithmetic, to illustrate the two methods, but what has been pointed out with regard to grammar and arithmetic will also apply to geography, etc. The grand maxim of the teacher should be to proceed from the known to the unknown, or in other words, to arrange his matter in such a way that the instruction should proceed from what the pupil knows of the subject to what he does not know.

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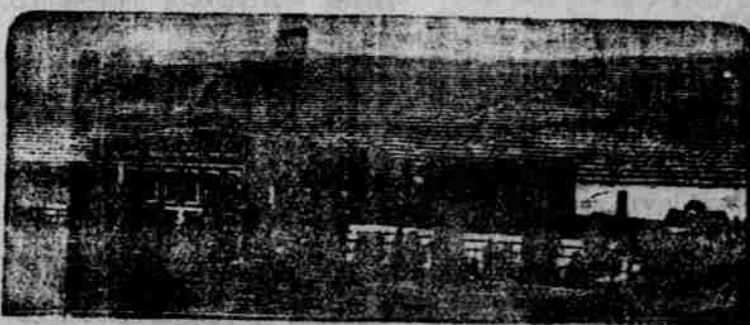
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